

The Immune System



What is the Immune System?



- Our body's natural defensive line to foreign material called microbes.
- Without an immune system, microbes would quickly attack our bodies.
- Our body has three levels of defense against foreign invaders.
 - Skin and mucous membranes
 - Inflammation and fever
 - The internal immune system

Immune Defense Level 1

Skin:

- The first line of defense.
- The outer layer that physically prevents larger microbes from entering our bodies.
- Pathogens may enter the body if the skin is cut, burned or punctured.

Mucous Membranes:

- Line the body cavities to trap the microbes and foreign substances.
- Hair in these cavities also trap and filter microbes, dust, and pollutants.
- Coughing, sneezing, and vomiting help accelerate the rate at which pathogens are moved out of the body.

Immune Defense Level 2

- **Inflammation** and **Fever** are nonspecific responses to microbes and tissue damage.
- Fever increases the body temperature to:
 - Prevent growth of the microbes
 - Speed up reactions in repair
 - Kill off any foreign invaders
- Inflammation occurs to isolate the substance from further contact with other parts of the body.

Immune Defense Level 3

- The **Internal Immune Response** is a *Specific Acquired Immunity*.
- Internal Immune Response also includes three steps in defense:
 - Identifying the microbe
 - Tagging the microbe to be killed
 - Remembering the microbe for future defensive strategies

Identifying the Enemy

- White Blood Cells, called **macrophages**, surround the microbe.
- It engulfs and degrades the microbe.
- Macrophages attack anything the body recognizes as foreign.

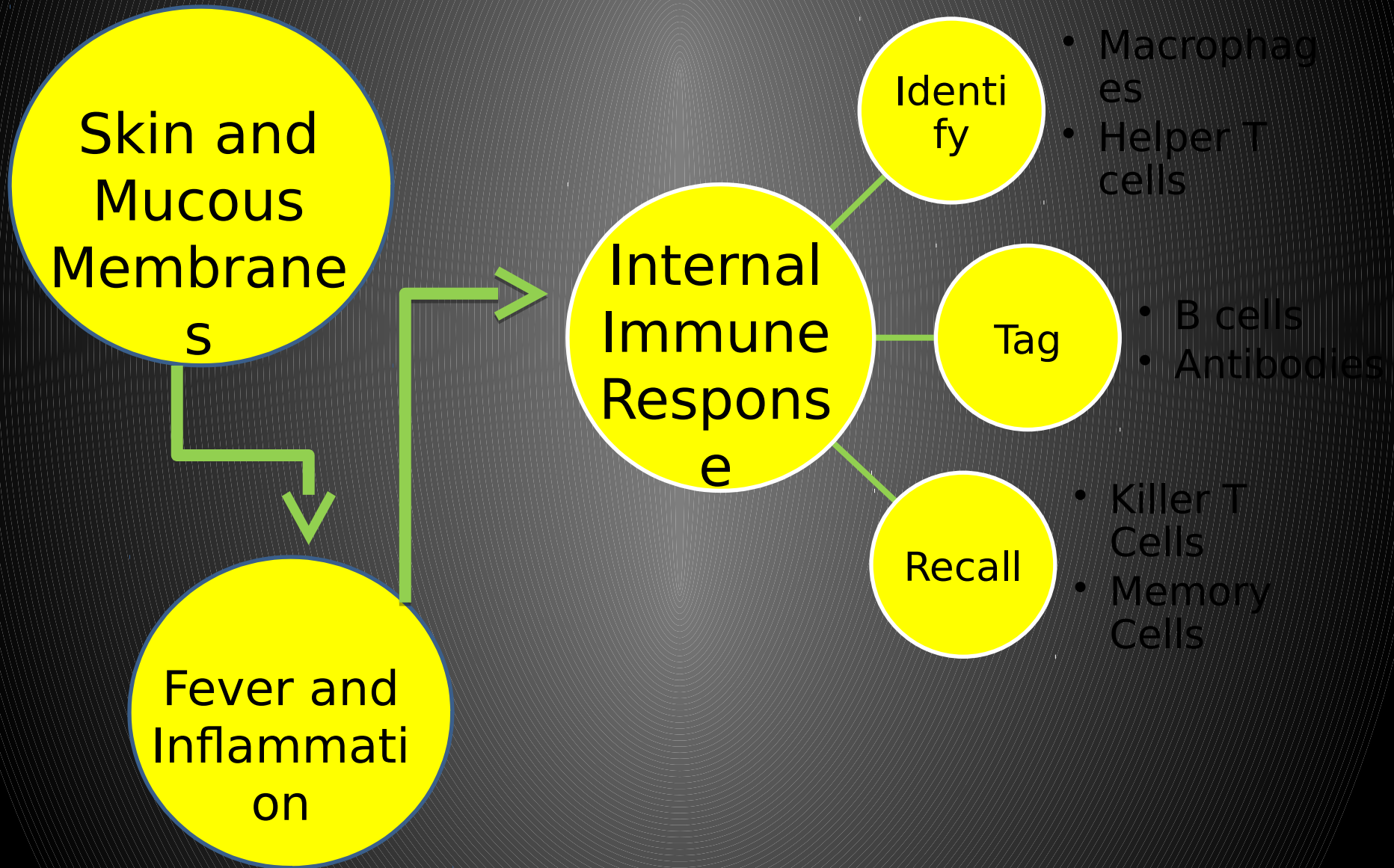
Tagging the Enemy

- Once the microbe is identified as foreign, other types of White Blood Cells, called **Helper T cells** classifies the microbe as an antigen (antibody generator).
- T cells recognize antigens, then recruit other cells, called **B cells**, to produce antibodies.
- T cells mature in the **thymus**, while B cells are produced in the **bone**

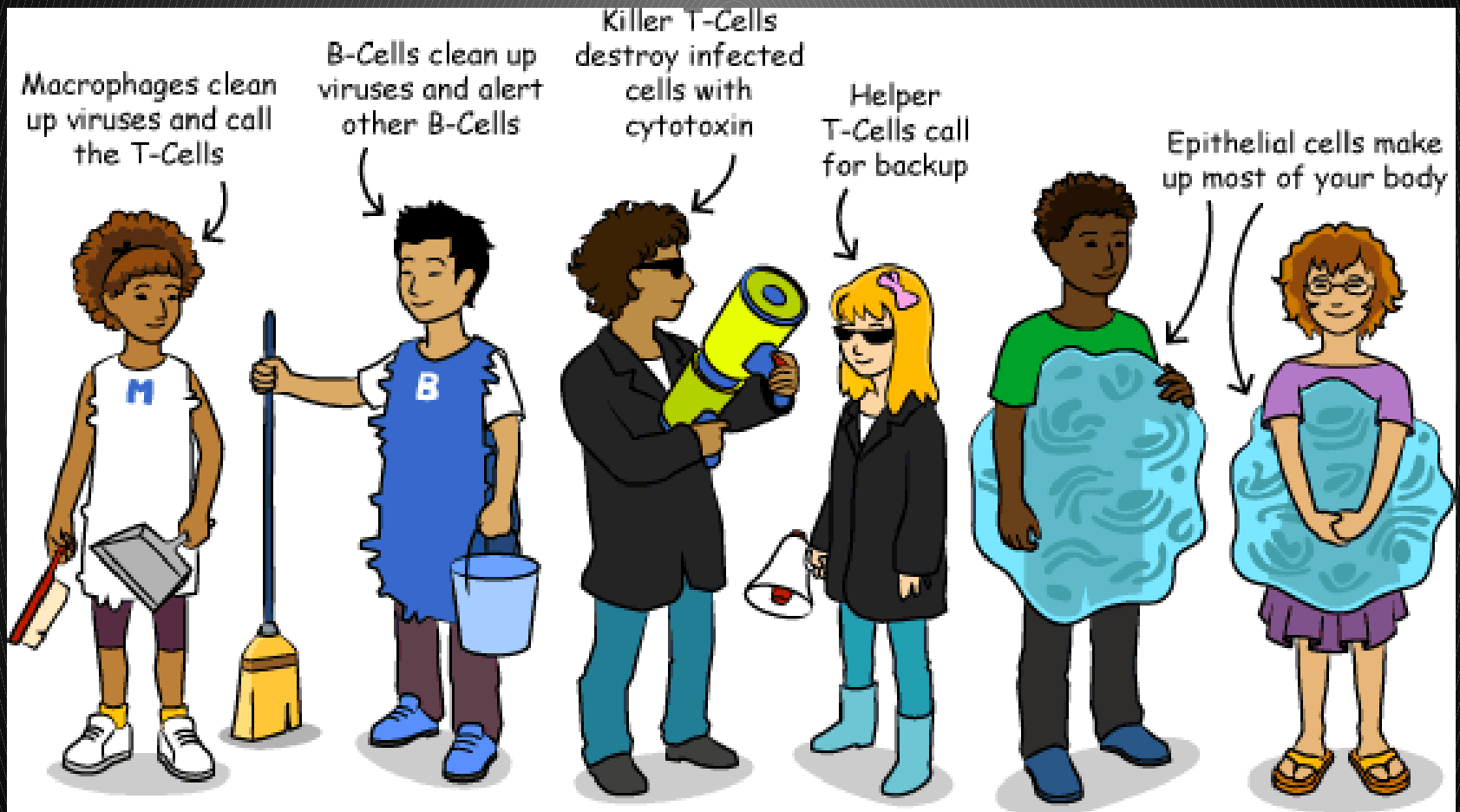
Remembering the Enemy

- **Memory T cells** are then used to identify microbes that have been encountered before.
- These T cells allow the immune system to have a faster and stronger response if that microbe is presented in the body again in the future.

Immune System Flow Chart

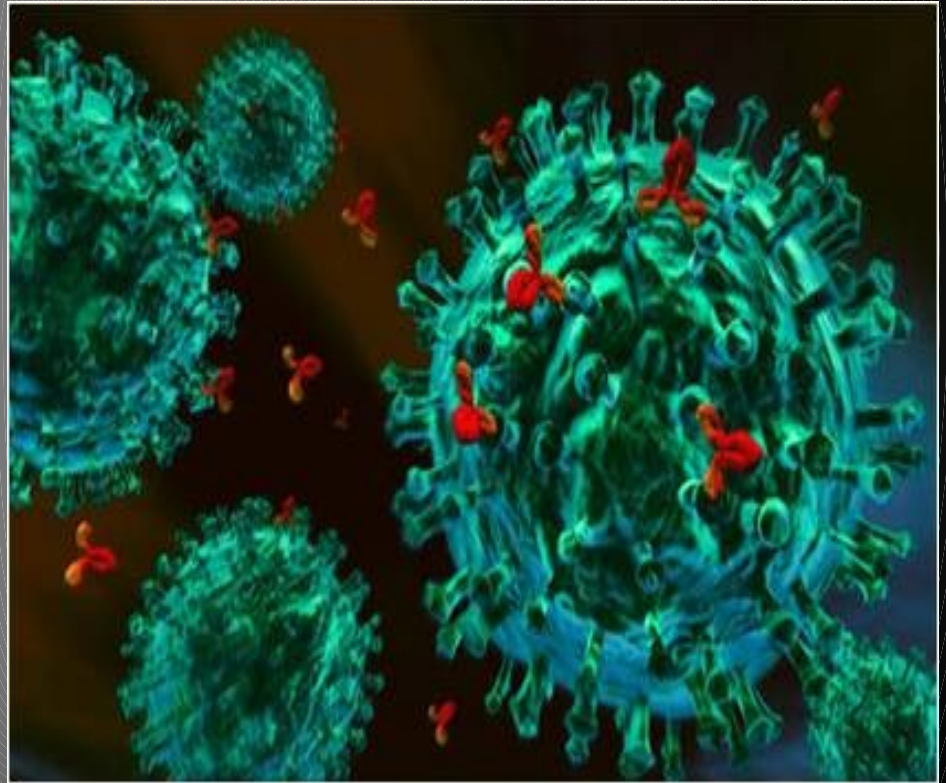


Key Players



Antigen vs. Antibody

- **Antibodies** bind to **antigens** to alert the **Killer T Cells** to destroy the antigen.
- The antigen is then destroyed, BUT WAIT! The fight is not over yet!
- Memory cells are then able to recognize the same antigen if it were to enter the body again.
- Memory cells can react and respond to that antigen, allowing a stronger and faster immune response.



Bacteria and Viruses Structures

Bacteria

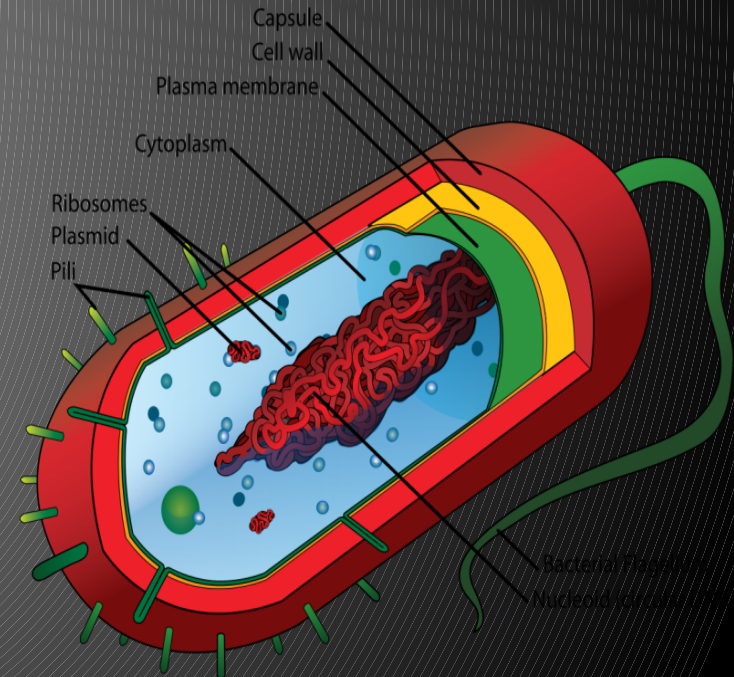
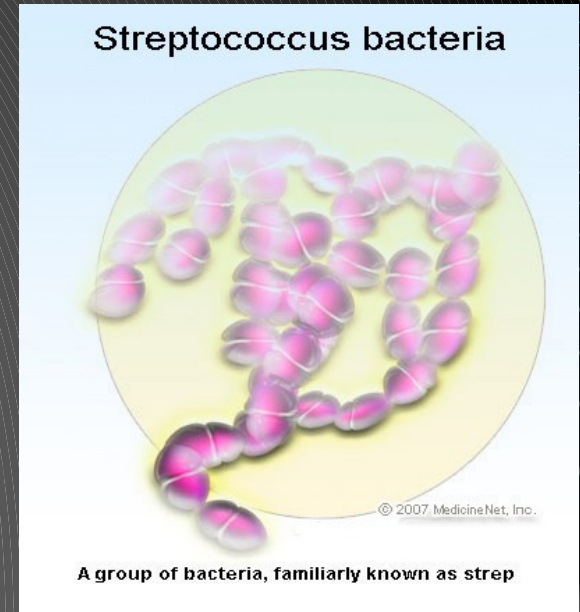
- Larger in size.
- Typically have a rigid cell wall, and a thin cell membrane surrounding cytoplasm.
- Contains DNA in chromosomes, or in plasmids floating around.
- Have ribosomes to copy DNA and reproduce
- May have flagella for movement.

Viruses

- The largest viruses are only as big as some of the smallest bacteria.
- Has a protein coat protecting the genetic material.
- Contains a core of genetic material, either DNA or RNA.
- May or may not have a spiky envelope on the outside.

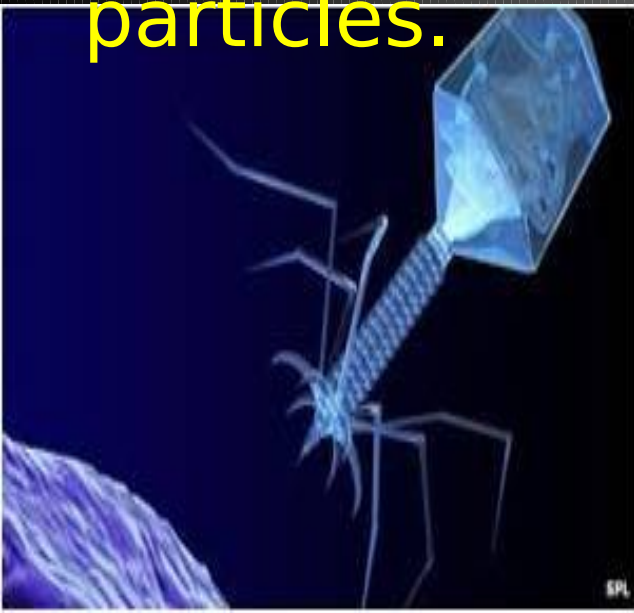
Bacteria

- Found in every environment on the earth including soil, water, hot springs, ice packs, and inside our bodies.
- Living cells, that have organelles, use energy, and are self-reproducing.
- Most are harmless to humans . Some are even beneficial (G.I. Tract, our skin, etc.)
- Harmful bacteria release toxic chemicals that weaken and destroy the cells in our body.



Viruses

- Viruses lay dormant (inactive) until it finds a host cell.
- Once it finds a host cell, it takes over the resources to rewire that cell to then produce more virus particles.



- Similar to robots, mostly have mechanized bits of information. NOT LIVING ORGANISMS.
- Cause illness by forcing cells to spend all of their energy making new viruses.



Antibiotics and Vaccines

Antibiotics:

- Alexander Fleming discovered the first antibiotic, penicillin, in the 1940s.
- Antibiotics interfere with the synthesis of nucleic acids and proteins.
- Can also destroy the cell wall of bacteria.
- Keeps specific types of bacteria or fungi from growing and reproducing once they enter the body.
- Cannot work against viral infections.



Vaccines:

- Imitate an infection, but does not cause illness.
- Vaccines contain **attenuated**, or weakened viruses, so your body can establish a defensive strategy.
- Causes the immune system to develop the same response as it does to a real viral infection.
 - This is so the body can recognize and fight certain viral infections

Careers

- **Immunologist**

- Immunologists are interested in diseases that affect natural immunity such as allergies, sinus inflammations, and pneumonia
- Ph.D or M.D needed

- **Medical & Clinical Laboratory Technician**

- Collect information on a patient's health by running routine laboratory tests. This information help doctor's to better diagnose and treat patients based on the blood cell counts. These laboratory tests can determine if an infection is bacterial or viral.
- Vocational or Associate's Degree needed

- **Cytotechnologist**

- Cytotechnologists take sample cells from a patient, make slides from them, and examine them under a microscope. When examining the cells, cytotechnologists look for abnormalities in cells to make a diagnosis of cancer or other diseases. These professionals help save lives by notifying doctors and pathologists the early detection of disease or cancer, allowing patients to receive treatments early.
- Bachelor's Degree needed

- **High School Classes to Take:**

- **Biology, chemistry, physics, algebra, geometry, biotechnology,**

Let's Review!

- What are the three levels of defense in our immune system? (Include the three steps in the third level).
- What are the names of the major cells that are a part of the immune response? (Be more specific than WBC).
- What cell produces antibodies?
- How does a virus attack the body differently than bacteria?
- How do antibiotics work against bacteria?
- How do vaccines work against viruses?